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[Document]

Specification

[Title of the Invention]

Ink Jet Recording Method and Ink Jet

Apparatus

[Claims]

1.   An ink jet recording method, in which a recording head comprising a plurality of aligned ink ejecting orifices is repeatedly moved in a scanning manner in the direction different from the direction in which the ink ejecting orifices are aligned, to incrementally form an image by sequentially forming a plurality of image sections, being characterized in that in order to form an image, in which the borders between two adjacent image sections corresponding to two adjacent scanning tracks of the ink jet recording head are as imperceptible as possible,

the portion of binary image formation data corresponding to one or both of the first and last rasters of a given scanning track of the recording head is divided into a plurality of processual binary data units equivalent to a predetermined number of dots;

the theoretical amount by which ink is to be ejected from the set of ink ejecting orifices

corresponding to each processual binary data unit is calculated from the processual binary data unit; and

the amount, by which ink is ejected from the set of ink ejecting orifices corresponding to the processual binary data, is reduced, based on the calculated theoretical amount, in a manner to reduce the dot count of the image section corresponding to the processual data unit.

2.   An ink jet recording method, in which a plurality of recording heads comprising a plurality of aligned ink ejecting orifices are repeatedly moved in a scanning manner in the direction different from the direction in which the ink ejecting orifices are aligned, to incrementally form a plurality of images different in colors, by sequentially forming a plurality of image sections, being characterized in that in order to form an image, in which the borders between two adjacent image sections corresponding to two adjacent scanning tracks of the ink jet recording head are as imperceptible as possible,

the portion of binary image formation data corresponding to one or both of the first an last raster of a given scanning track of the recording head is divided into a plurality of processual binary data units equivalent to a predetermined number of dots; and

a correction process, in which the amount, by which ink of a given color is ejected from the set of ink ejecting orifices corresponding to each processual binary data unit, is reduced, based on the calculated theoretical amount by which the ink of the given color is to be ejected from the set of ink ejecting orifices corresponding to the processual binary data unit, according to the given processual binary data unit, and the total of the amounts by which the inks of the colors other than the given color are ejected, according to the same processual binary data unit, is sequentially repeated for all the processual binary data units and all the colors, in a manner to reduce the dot count of the image section corresponding to the processual data unit for each color.

3. An ink jet recording method according to Claim 2, wherein the dot count of the image section corresponding to a given processual binary data unit is reduced with reference to a correction table prepared for each color in advance to show the relationship among the amount by which the ink of a given color is ejected by the set of ink ejecting orifices corresponding to the given processual binary data unit, the total of the amounts by which the inks of the colors other than the given color are ejected by the sets of ink ejecting orifices for the inks of

the other colors corresponding to the same processual binary data unit, and the correct amount by which the ink of the given color should be ejected.

4.   An ink jet recording apparatus, which repeatedly moves a recording head comprising a plurality of aligned ink ejecting orifices, in a scanning manner in the direction different from the direction in which the ink ejecting orifices are aligned, to incrementally form an image by sequentially forming a plurality of image sections, being characterized in that in order to form an image, in which the borders between two adjacent image sections corresponding to two adjacent scanning tracks of the ink jet recording head are as imperceptible as possible, the ink jet recording apparatus comprises:

means for dividing the portion of binary image formation data corresponding to one or both of the first and last rasters of a given scanning track of the recording head, into a plurality of processual binary data units equivalent to a predetermined number of dots, and calculating the theoretical amount by which ink is to be ejected from the set of ink ejecting orifices corresponding to each processual binary data unit, based on the processual binary data unit; and

dot-thinning means for reducing the amount,

in terms of dot count, by which ink is ejected from
the set of ink ejecting orifices corresponding to the
processual binary data, based on the calculated
theoretical amount, in a manner to reduce the dot
count of the image section corresponding to the
processual data unit.

5.   An ink jet recording apparatus according to
Claim 4, wherein said dot-thinning means carries out
the dot-thinning process by referring to correction
tables prepared in advance to show the relationship
between the calculated theoretical amount by which ink
is ejected, and the correct amount by which ink should
be ejected.

6.   An ink jet recording apparatus according to
Claim 5, wherein said correction tables are
independently prepared for each of the primary colors.

7.   An ink jet recording apparatus according to
Claim 5 or 6, wherein said correction tables show the
relationship among the amount by which the ink of a
given color is ejected by the set of ink ejecting
orifices corresponding to a given processual binary
data unit, total of the amounts by which the inks of
the primary colors other than the given color are
ejected by the set of ink ejecting orifices for the

other colors, according to the same processual binary data unit, and, correct amounts by which the ink of the given primary color should be ejected.

8.   An ink jet recording apparatus according to Claim 5, 6, or 7, wherein a plurality of correction tables are prepared according to recording conditions inclusive of at least recording medium type, and are selectively used according to the recording conditions.

9.   An ink jet recording apparatus according to any of Claims 4 - 8, wherein the priority order in which the dots corresponding to each processual binary data unit are eliminated is predetermined according to dot position.

10.   An ink jet recording apparatus according to Claim 9, wherein if the dots corresponding to the first and last rasters of a given scanning track are the targets of the dot-thinning process, the first and last rasters are made different from each other in the priority order in which the dots corresponding each processual binary data unit are eliminated.

[Detailed Description of Invention]
[Field of the Invention]

The present invention relates to an ink jet
recording apparatus employing a single-pass recording
method.

[Description of the Prior Art]

Generally speaking, when forming an image
using an ink jet recording apparatus, a recording head
comprising a plurality of aligned ink ejecting
orifices from which ink is ejected is repeatedly moved
in a scanning manner in the direction different from
the direction in which the ink ejecting orifices are
aligned. Therefore, each scanning run of the
recording head in the primary scanning direction
results in the formation of an image section in the
form of a band. As each image section is formed, ink
sometimes bleeds at the edges of the image section in
the form of a band, due to recording medium
properties, for example, surface condition. Thus,
the so-called "border streak", a type of image defect,
is sometimes created between two adjacent image
sections.

All that is necessary to prevent the
occurrence of this defect is to employ one of the
multi-pass recording methods in which a given portion
of an image equivalent in size to the above described
image section in the form of a "band" in a single-pass
method is completed by moving the recording head a
plurality of times in the primary scanning direction,

across the portion of recording medium corresponding

to the given portion of the image. However, the

employment of a multi-pass recording method reduces

recording speed, which is a problem.

[Problems to be Solved by the Invention]

There are various technologies for preventing

the occurrence of the border streak in a single-pass

ink jet recording apparatus. For example, there is the

technology disclosed in Japanese Laid-open Patent

Application 7-89099. This technology prevents the

occurrence of the border streak by reducing the amount

of ink bleeding by reducing the values of the

recording signals (multi-value signals) for recording

the image section straddling the border between two

adjacent "bands".

This method, however, suffered from the

following faults because the attempt to prevent the

occurrence of the border streak was made at the image

formation signal level.

That is, first, most of the widely used

ink jet recording apparatuses are connected, as

peripheral apparatuses, to a computer or the like.

Thus, the image formation data are processed by the

computer or the like (for example, converted into

binary data), and are transferred to an ink jet

recording apparatus to record images. Also, providing

an ink jet recording apparatus with an image formation

data input portion or image formation data processing
portion, which processes multi-value signals,
increases the cost of the apparatus, as well as the
signal processing time of the apparatus. Thus,
providing an ink jet recording apparatus for the
general public with such a data processing portion is
not practical. In addition, the prevention of the
border streak at the image formation signal level
requires an ink jet recording apparatus to spend a
substantial amount of time to convert multi-gradation
image formation data into binary image formation data;
in other words, it wastes time, reducing recording
speed. In comparison, an ink jet recording apparatus
in accordance with the present invention does not
prevent the border streak at the multi-value image
formation signal level. Instead, it targets binary
image formation data in order to prevent the border
streak.

Second, all ink jet recording apparatuses are
not the same in properties, for example, the distance
by which recording medium is moved in the secondary
scanning direction, and also, all recording media are
not the same in properties. Thus, all ink jet
recording apparatuses and recording media are not the
same in the amount by which ink bleeds. Thus, it is
difficult to satisfactorily prevent the border streak
with the use of the above described prior technology.

Further, unless precise information regarding the borders between two adjacent scanning tracks of a given ink jet recording apparatus is available, it is very difficult to make corrections with the use of the host apparatus such as a computer.

Thus, the present invention was made to solve the above described problem, and its object is to provide a single-pass ink jet recording apparatus capable of preventing the occurrence of an unwanted streak at the border between two adjacent image sections, by processing binary image formation data on the side of an image recording apparatus.

Another object of the present invention is to provide a single-pass ink jet recording apparatus capable of minimizing the possibility that an unwanted streak will appear at the border between two adjacent bands of image sections due to the variances among ink jet recording apparatuses, and the variance in bleeding among recording media, by processing binary image formation data on the ink jet recording apparatus side.

[Means for Solving Problems]

According to the present invention made to accomplish the above described objects, an ink jet recording method, in which an image is incrementally formed by sequentially forming a plurality of image sections by repeatedly moving a single or plurality of

recording heads comprising a plurality of aligned ink
ejecting orifices, in a scanning manner in the
direction different from the direction in which the
ink ejecting orifices are aligned, is characterized in
that in order to form images in which the so-called
border streaks are as imperceptible as possible, the
portion of the image formation data corresponding to
one or both of the first and last rasters of a given
scanning track of the recording head, is divided into
a plurality of processual data units equivalent to a
predetermined number of dots; the theoretical amount
by which ink is to be ejected by the ink ejecting
orifices corresponding to one or both of the first and
last rasters, according to a given processual binary
image formation data, while they are moving across the
portion of recording medium corresponding to each
processual data unit, is calculated; and the amount by
which ink is ejected by the ink ejecting orifices
corresponding to one or both of the first and last
rasters is reduced, based on the calculated
theoretical amount, by dot-thinning, that is, by
reducing the number of dots to be printed on the
portion of the recording medium corresponding to the
given processual data unit.

   According to this method, the amount by which
ink is ejected along the border between two adjacent
image section corresponding to two adjacent scanning

tracks can be corrected using the binary image formation data, making it unnecessary to modify the processes carried out by the external apparatus such as a computer. In other words, the process for minimizing the possibility that the unwanted streaks will be effected at the border between two adjacent image section corresponding to two adjacent scanning tracks can be carried out on the ink jet apparatus side.

Also according to this method, the portion of the image formation data corresponding to the rasters corresponding to the target areas for correction are divided into a plurality of relatively small processual data units, making it possible to reduce process load without reducing print quality.

According to another aspect of the present invention, an ink jet recording method, in which an image is incrementally formed by sequentially forming a plurality of image sections by repeatedly moving a plurality of recording heads, one for each color, comprising a plurality of aligned ink ejecting orifices, in a scanning manner in the direction different from the direction in which the ink ejecting orifices are aligned, is characterized in that the portion of the image formation data corresponding to one or both of the first and last rasters of each scanning track of each recording head is divided into

a plurality of processual data units equivalent to a
predetermined number of dots; and a correction process
(dot-thinning process) in which the amount, in terms
of dot count, by which the ink of a given color is
ejected by the ink ejecting orifice corresponding to
the raster next to the border between two adjacent
scanning tracks while the ink ejecting orifice is
scanning the recording medium section corresponding to
each processual data unit, is reduced, based on the
theoretical amount by which the ink of the given color
is to be ejected, according to the given processual
binary image formation data, by the ink ejecting
orifices for the given color corresponding to one or
both of the first and last rasters of the scanning
track, while the ink ejecting orifices are scanning
the recording medium section corresponding the given
processual data unit, and also, the total of the
theoretical amounts, in terms of dot count, by which
the inks of the colors other than the given color are
ejected, according to the same processual binary image
formation data unit, by the ink ejecting orifices for
the colors other than the given color corresponding to
the same raster or rasters of the same scanning track,
while the ink ejecting orifices are scanning the same
recording medium section, is sequentially carried out
for all the processual data units of all colors; and
the ink ejecting orifices corresponding in position to

the first or last raster of a given scanning track are made to eject ink by the corrected amounts while they are moving across the recording medium portion corresponding to the given processual data unit to reduce the number by which dots are printed while the ink ejecting orifices are scanning across the recording medium portion corresponding to the given processual data unit.

It is preferable that the aforementioned ink dot-thinning process is carried out with reference to a single or plurality of prepared correction tables containing the correct amount by which the ink of a given color should be ejected by the ink ejecting orifice corresponding to the first or last raster of a given scanning track of the recording head while the ink ejecting orifice is scanning the recording medium portion corresponding to a given processual data unit, along with the amount by which the ink of the given color is ejected by the ink ejecting orifice for the ink of the given color corresponding to the first or last raster of a given scanning track of the recording head, according to the given binary image formation data unit, while the ink ejecting orifice is scanning the recording medium portion corresponding to the given processual data unit, and the total of the amounts by which the inks of the colors other than the given color are ejected by the ink ejecting orifices

for the inks of the colors other than the given color
corresponding to the same raster, according to the
same processual binary image formation data unit,
while the ink ejecting orifices are scanning the same
recording medium portion. The usage of the prepared
correction tables can speed up the correction process.
Further, the preparation of a plurality of correction
tables according to the correction target, for
example, image section, color, recording medium type,
etc., makes it possible to carry out in a more
appropriate manner the correction process for
minimizing the possibility of the occurrence of the
border streak.

An ink jet recording apparatus in accordance
with the present invention, which incrementally forms
an image on recording medium by sequentially forming a
plurality of image sections in the form of a band by
repeatedly moving its single or plurality of recording
heads comprising a plurality of aligned ink ejecting
orifices, in a manner to scan the recording medium in
the direction different from the direction in which
the ink ejecting orifices are aligned, is
characterized in that it comprises a means for
dividing the portion of binary image formation data
corresponding to one or both of the first and last
rasters of a given scanning track of the recording
head, into a plurality of processual image formation

data units equivalent in size to a predetermined

number of ink dots, and calculating the theoretical

amount by which the ink ejecting orifice or orifices

corresponding to one or both of the first and last

rasters while the ink ejecting orifice or orifices are

scanning the portion of the recording medium

corresponding to the given processual image formation

unit, and a thinning means for reducing the amount, in

terms of dot count, by which ink is ejected by the ink

ejecting orifices or orifices corresponding to one or

both of the first and last rasters of the given

scanning track of the recording head, in a manner to

reduce the number of ink dots printed while the

orifice or orifices are scanning the portion of the

recording medium corresponding to the given processual

image formation data unit, in order to minimize the

possibility of the occurrence of the unwanted streak

at the borders between two adjacent portions of the

image corresponding to two adjacent scanning tracks of

the recording head.

The above described thinning means is desired

to carry out the thinning process with reference to a

single or plurality of prepared correction tables

containing the theoretical amount by which ink is to

be ejected, and the corrected amount by which ink

should be ejected.

Regarding the above described correction

tables, a plurality of correction tables may be individually prepared according to ink color, one for one. The usage of the correction tables speeds up the correction processes.

The correction tables contain the corrected amounts by which ink should be ejected, which were determined based on, for example, the theoretical amounts by which the ink of a given color is to be ejected by the ink ejecting orifice or orifices corresponding to one or both of the first and last rasters of a given scanning track of the recording head while the ink ejecting orifice or orifices are scanning the portion of recording medium corresponding to a given processual image formation data unit, and the total of the theoretical amounts by which the inks of the colors other than the given color are ejected by the ink ejecting orifices other than the ink ejecting orifice for the ink of the given color, corresponding to the same raster or rasters, according to the same processual image formation data unit, while they are scanning the same portion of the recording medium.

There may be prepared a plurality of correction tables according to the type of recording condition inclusive of at least the type of recording medium, in order to make it possible for the correction tables to be selectively used according to

the recording condition type.

The priority order in which a given dot within a set of ink dots corresponding to a given processual image formation data unit is eliminated is desired to be prepared based on its position within the set of the ink dots. Further, it is desired to be prepared so that when two or more ink dots in the set of the ink dots are to be eliminated, any two ink dots to be sequentially eliminated will not be adjacent to each other.

It is desired that when the dot-thinning process is carried out on both the portion of the image formation data corresponding to the first raster of a given scanning track of the recording head and the portion of the image formation data corresponding to the last raster of the preceding scanning track of the recording head, the priority order in which each ink dot is eliminated from the first raster is differentiated from the priority order in which each ink dot is eliminated from the last raster.

[Detailed Description of the Invention]

Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to the appended drawings.

Figure 1 is a block diagram showing the general structure of the ink jet recording apparatus in accordance with the present invention. In the

drawing, a reference code 11 stands for a CPU for
controlling the overall operation of the apparatus,
and a referential code 12 stands for a RAM used as an
operational region for the CPU 11 and a temporary data
storage region. Designated by a referential code 13
is a ROM, in which the programs and data for driving
the ink jet recording apparatus are stored, and which
is used by the CPU 11. Designated by a referential
code 14 is an interface portion through which the
image forming apparatus is connected to an external
apparatus (unshown) such as a computer, and also,
through which binary data are transferred to the
ink jet recording apparatus. Designated by a
referential code 15 is a liquid crystal display for
displaying the graphic man/machine interfaces, and
designated by a referential code 16 is a keypad for
selecting the various settings of the ink jet recording
apparatus. A referential code 17 stands for a
printing portion employing a single or plurality of
ink jet heads, and a referential code 18 stands for a
system bus for connecting the CPU 11 to various
elements in the apparatus.

The printing portion 17 comprises four ink jet
heads for ejecting four different inks, that is, black
(K) ink, cyan (C) ink, magenta (M) ink, and yellow (Y)
ink, one for one. In this embodiment, each ink jet
head has 128 nozzles, and ejects ink droplets in

response to binary image formation data.

Figure 2 is a flowchart of the image formation process, showing from the input data reception to the actual printing, of the image forming apparatus in accordance with the present invention.

First, the image formation data are received from an external source (S21). The received data are analyzed and divided into a plurality of blocks of printing data, each of which corresponds to an image section printable by a single scanning run of the ink jet recording apparatus in the primary scanning direction (S22). Next, the amount of each color ink to be ejected (in terms of dot count) is computed for the first and last rasters of the first scanning track of the ink jet head (S32). Then, the printing data are corrected with reference to a single or plurality of correction tables 28 (S24). Then, in order to print an image, each ink jet head is driven based on the image formation data corrected as described above (S25). The above described process is repeated until the entirety of the image is completed (S26).

Figure 3 is a drawing for describing the correction process carried out for correcting the amount by which ink is ejected from each ink jet head. In this case, the amount by which ink is ejected onto the areas of a recording medium corresponding to the first and last rasters of each scanning tracks the

ink jet head is corrected, except that the amount by which ink is ejected onto the areas of the recording medium corresponding to the first raster of the first scanning track and the last raster of the last scanning track is not corrected.

For example, if the number of the nozzles each ink jet head has is 128, the number of nozzles per scanning track is also 128. Thus, the ink droplets ejected by the first and 128th nozzles are the targets of the correction. All nozzles do not necessarily eject ink while scanning recording medium. Therefore, the nozzles which are to be controlled in terms of the amount by which ink is ejected therefrom are not necessarily the first and last nozzles of the single column of nozzles.

Although, in this embodiment, the portions of the image formation data corresponding to the first and last rasters of each scanning track are selected as the correction targets, the portions of the image formation data corresponding to two or more rasters on one or both of the starting and ending sides of each scanning track may be selected as the targets for correction. In particular, when recording medium which is likely to suffer from bleeding is used, it is desired to make corrections for the portions of the image formation data corresponding to two or more rasters. In other words, whether corrections should

be made for the portions of image formation data corresponding to one or two rasters on one or both of the starting and ending sides of each scanning track may be determined based on the properties of an individual ink jet recording apparatus and the predicted amount of the bleeding (one of paper properties) which a given recording medium suffers.

Next, the process for correcting the amount by which ink is ejected by the ink ejecting orifices adjacent to the border between two adjacent scanning tracks will be described.

First, the image portion straddling the border of the two adjacent scanning tracks is divided into a predetermined number of areas which are identical in shape and size. In consideration of the relationship between the amount of work and the effects thereof, the portion of the image formation data corresponding to the image portion corresponding to the last raster of the preceding scanning track and the first raster of the following scanning track is selected as the correction target. The portion of image formation data corresponding to each raster is divided into a plurality of processual image formation data units equivalent to 5 x 1 dot matrix. However, this division is not intended to limit the scope of the present invention. In other words, as described above, the portion of the image formation data, for

which the ejection amount correction is made, does not
need to be limited in size so that this portion of the
image formation data encompasses only a single raster
on each side of the border. Further, the dot count in
each matrix does not need to be limited to five.

Figure 4 is a schematic drawing of the image
formation data (for Y, M, C, and K colors) which
correspond to a given image portion encompassing a
single raster divided into a plurality of 5 x 1 dot
matrixes. The right end matrixes, that is, the
incomplete matrixes, cannot be properly processed by
the correction process to which the rest are
subjected, and also, leaving them unprocessed has
little effect upon the outcome of the correction
process. Therefore, these matrixes are omitted from
the correction targets.

The correction process is carried out for the
portion of the image formation data corresponding to
each of the image portions straddling the border
between two adjacent scanning tracks, and also, for
each color. For example, in order to obtain the
correct amount by which yellow ink should be ejected
from the orifices corresponding to a given processual
image formation data unit, first, the theoretical
number ($0 \leq x \leq 5$) of times yellow ink is to be
ejected by the yellow ink ejecting orifice
corresponding to the processual image formation data

unit, according to the processual image formation data
unit, while the ink ejecting orifice is scanning the
portion of recording medium corresponding to the
processual image formation data unit, as well as the
total y ($0 \leq x \leq 15$) of the theoretical numbers of
times magenta, cyan, and black inks are each ejected
by the magenta, cyan, and black ink ejecting orifices
corresponding to the same processual image formation
data unit, according to the same image formation data
unit, while they are scanning the same portion of the
recording medium, are obtained. Then, the correct
amount by which yellow ink should be ejected is
obtained from a correction table, which was prepared
through experiments, and which contains the
theoretical dot count z ($0 \leq x \leq 5$) capable of
minimizing the possibility of the occurrence of the
border streak between two adjacent image portions
corresponding to the two adjacent scanning tracks. As
for the correction table, it is prepared for each of
the four inks different in color. The correction table
for the ink of a given color shows the relationship
among the amount x by which the ink of the given color
is ejected according to the original image formation
data, the total y of the amounts by which the inks
other than the ink of the given color are each ejected
according to the original image formation data, and
the correct dot counts z ($0 \leq x \leq 5$) which minimize

the possibility of the occurrence of the border streak
between two image portions corresponding to two
adjacent scanning tracks. Thus, there are four
correction tables Y, M, C, and K, one for each color.
Therefore, a proper correction value can be obtained
for each color. However, this embodiment is not
intended to exclude a table setup different from the
one in this embodiment, for example, a setup in which
a single common correction table is used for all four
colors, a setup in which one common correction table
is prepared for correcting the amount by which the Y,
M, and C inks are ejected, and another correction
table is prepared exclusively for correcting the
amount by which K ink is ejected.

Thus, the correct value for the amount by
which the ink of a given color should be ejected can
be obtained by referring to the correction table,
which contains the values of the x and y obtained from
the original binary image formation data, and the
correct values corresponding to the values of the x
and y. Then, the amount by which the ink of the given
color is ejected from the ink ejecting orifice
corresponding to the processual image formation data
unit is reduced in the following manner. For example,
when the value of the dot count x for yellow color
corresponding to a given processual image formation
data unit is 5, and the value of the total y of the

dot counts for the colors other than yellow
corresponding to the same processual image formation
data unit is 3, the correct value, in terms of dot
count, of the amount by which yellow ink should be
ejected by the ink ejecting orifice corresponding to
the given processual image formation data is 1. The
correction process is carried out for each of the
other colors. It will be described later which dot or
dots within a set of dots corresponding to a given
processual image formation data unit are to be
eliminated when the dot count for a given color must
be reduced.

Figure 7 is a correction table 28, that is, a
concrete example of the correction table, in which the
dot count corresponding to a given processual image
formation data unit is 5. As described before, the
relationship among the amount x by which the ink of a
given color is to be ejected according to the original
binary image formation data, and the total y of the
amounts by which the inks of the colors other than the
given color are ejected according to the original
binary image formation data, and the ideal amount by
which the ink of the given color should be eject to
minimize the possibility of the occurrence of the
border streak between two adjacent image portions
corresponding to two adjacent scanning tracks, is
predetermined for each color (Y, M, C, or K) through

experiments, and is presented in the form of the correction table for each color.

Two separate correction tables may be prepared for the plurality of the processual image formation data units for the first raster of a given scanning track, and those for the last raster of the same scanning track, one for one. Such an arrangement makes it possible to make the processual image formation data unit corresponding to first raster different in correction value from that corresponding to the last raster, providing a finer correction process.

Figure 5 is a schematic drawing showing how the amount by which the ink of a given color is ejected by the ink ejecting orifice corresponding to a given processual image formation data unit is reduced, more specifically, the priority order in which each of the set of dots corresponding to the given processual image formation data unit is eliminated (dot-thinning process). The priority order is set so that two adjacent numerical values representing the priority order in which each of the set of dots corresponding to the given processual image formation data unit do not become sequential. The priority order is also set so that a given processual image formation data unit corresponding to the last raster (raster immediately above border) of the preceding scanning track and the

locationally corresponding processual image formation data unit corresponding to the first raster (raster immediately below border) of the following scanning track become different in the priority order for dot elimination. In this embodiment, the priority numbers of the first to fifth dots, listing from the left side, corresponding to a given processual image formation data unit corresponding to the last raster, in terms of the order in which the dots are subjected to the dot-thinning process are, 1, 3, 5, 2, and 4, and the priority number of the first to fifth dots, also listing from the left side, corresponding to a given processual image formation data unit corresponding to the first raster, in terms of the order in which the dots are subjected to the dot-thinning process, are 5, 3, 1, 4, and 2. The objective of making the priority number in terms of the subjection to the dot-thinning process different from the ordinal number in terms of position is to prevent the dot-thinning process from degrading image quality. The above arrangement of the priority number is just an example, and is not intended to limit the scope of the present invention.

To describe more concretely, if the theoretical amount, in terms of dot count, by which the ink of a given color is ejected by the ink ejecting orifice corresponding to a given processual

image formation data unit corresponding to the last
raster of a given scanning track, according to the
original image formation data, is 4, and the correct
amount, in terms of dot count, found in the correction
table 28 with reference to the total of the amounts by
which the inks of other colors are ejected, is 1, the
amount in terms of dot count, by which the ink of the
given color is ejected, is reduced from 4 to 1, being
reduced by 3 dots; it must be reduced by 3 dots.
Thus, first, it is checked whether or not the first
dot, counting from the left side, is to be printed
according to the given processual unit of the inputted
image formation data. If the first dot is to be
printed according to the given processual unit of the
inputted image formation data, control is executed so
that this dot is not printed. If the first dot is not
to be printed according to the given processual unit
of the inputted image formation data, it is checked
whether or not the second dot is to be printed. If
the second dot is to be printed, control is executed
so that the second dot is not printed. This process
is consecutively carried out, following the priority
order, until the dot density is reduced by three dots
(in other words, until ink ejection amount in terms of
dot count is reduced to 1). The process for thinning
the dots corresponding to the first raster is carried
out following the priority order different from that

for the last raster, as described before.

Figure 6 is a schematic drawing showing the portions of an image corresponding to a plurality of processual image formation data units, one for one, and the sets of dots encompassed by the portions of the image, in another embodiment of the present invention. Referring to Figure 6(a), on the top side of the border, the portions of the image corresponding to the last two rasters, that is, n-th and (n-1)-th rasters of the preceding scanning track are subjected to the dot-thinning process, and the image portion corresponding to the last two rasters is divided into a plurality of processual units equivalent to 5 x 2 dot matrix, whereas on the bottom side of the border, the image formation data corresponding to the image portion corresponding to the first raster of the following scanning tracks is divided into a plurality of processual image formation data units equivalent to 5 x 1 dot matrix, as in Figure 5. The top and bottom sides of the border may be reversed in the number of the rasters, the image formation data for which are subjected to the dot-thinning process; a single raster on the top side and two rasters on the bottom side.

Figure 6(b) depicts a case in which the image formation data corresponding to two rasters are process on both the top and bottom sides of the border, and the image formation data for the image

portions corresponding to the two rasters on the top and bottom sides of the border are divided into a plurality of processual image formation data units equivalent to 5 x 2 dot matrix.

The dot matrix configurations shown in Figure 6 are remarkably effective when images are recorded on recording medium susceptible to bleeding. The numerical values in the drawings represent the priority order in which each of the set of dots corresponding to a given processual image formation data unit is subjected to the dot-thinning process. Also in this case, the priority is set so that the ordinal numbers for two adjacent dots do not become sequential.

Heretofore, some of the preferable embodiments of the present invention were described, and the present invention encompasses the various modifications of these embodiments.

As for an example of the modifications of the preceding embodiments, it may be on only one side of the border where corrections are made to the amounts by which inks are ejected from the orifices next to the border.

Further, a plurality of discrete correction tables such as the above described correction table may be prepared according to the range of the amount of the bleeding which various recording media suffer,

so that a correction table appropriate in terms bleeding can be selected according to the recording medium selection by a user. Further, there are various kinds of recording media, for example, ordinary paper, coated paper, glossy paper, film, etc. Thus, with the preparation of the plurality of the correction tables according to the various properties of recording medium, the table selection can be switched according to the properties of each medium, a group of media, etc.

In anticipation of situations in which the values found in the correction tables (primary tables) prepared through experiments do not provide satisfactory results due to the variation in the remaining amount of ink, ambient temperature, ambient humidity, variation among recording mediums, etc., a plurality of auxiliary correction tables may be prepared (or calculated) by multiplying the values in the primary correction tables by a coefficient in the range of 0.5 - 1.5 (fractions are rounded to nearest whole number), so that the values in the auxiliary correction tables can be selected prior to the actual printing operation. The preparation of such auxiliary correction tables makes the preceding embodiments of the present invention more effective.

In the preceding embodiments, the values in the correction tables represented the correct amount,

in terms of dot count, by which ink should be ejected in order to minimize the possibility of the occurrence of the border streak between two adjacent image portions corresponding to two sequential scanning tracks of the ink jet recording head. However, the correction tables may be set up so that the values represent the number by which dots should be thinned.

[Effects of Invention]

According to the present invention, the amount by which ink is ejected along the border between two adjacent scanning tracks can be corrected with the use of the binary image formation data, making it possible to carrying out on the ink jet recording side, the correction process for making it possible to form images, in which the border lines between two adjacent image sections corresponding to two adjacent scanning tracks is as imperceptible as possible, eliminating the need for the image formation data to be modified on the side of a host apparatus such as a computer. Further, according to the present invention, the image formation data are divided into a plurality of relatively small data blocks which are sequentially subjected to the correction process. Therefore, process load is reduced without sacrificing print quality. Moreover, according to the present invention, correction tables are prepared to make it possible to quickly carry out the correction process.

Further, a plurality of correction tables are
individually prepared according to the image areas
targeted for correction, image color, recording medium
type, etc., making it possible to carrying out the
correction process in the most appropriate manner for
forming images in which the border lines are as
imperceptible as possible.

[Brief Description of the Drawings]

Figure 1 is a block diagram for showing the
general structure of a typical ink jet recording
apparatus in accordance with the present invention.

Figure 2 is a flowchart of the correction
process starting from the reception of the data from
the ink jet recording apparatus shown in Figure 1 to
the actual printing.

Figure 3 is a schematic drawing for depicting
the correction process, in one of the embodiments of
the present invention, for correcting the amount by
which ink is ejected.

Figure 4 is a schematic drawing for showing
the four sets of image formation data for Y, M, C, and
K colors, one for one, each of which is divided into a
plurality of blocks of data, or processual data units,
each of which is equivalent to 5 x 1 dot matrix.

Figure 5 is a schematic drawing for showing
the priority order in which the set of ink ejecting

orifices corresponding to each processual data unit are controlled to reduce the amount by which ink is ejected from the set of ink ejecting orifices, in one of the embodiments of the present invention.

Figure 6 is a schematic drawing for showing the priority order in which the set of ink ejecting orifices corresponding to each processual data unit are controlled to reduce the amount by which ink is ejected from the set of ink ejecting orifices, in another embodiment of the present invention.

Figure 7 is a concrete example of a set of correction tables in which the dot count in each processual data unit is 5, in one of the embodiments of the present invention.

[List of Reference Numerals]

    11: CPU

    12: RAM

    13: ROM

    14: interface portion (I/F)

    15: liquid crystal display

    16: key pad

    17: printing portion

    8:   system bus

    28: correction table

[Document]

Abstract

[Abstract]

[Object of the Invention]

To provide a single-pass ink jet recording
apparatus capable of processing binary image formation
data in order to form images, in which border lines
between two adjacent image sections corresponding to
two adjacent scanning tracks are as imperceptible as
possible.

[Solution]

The portion of the binary image formation
data corresponding to one or both of the first and
last rasters of each scanning track of a recording
head is divided into a plurality of small processual
data units equivalent in size to a predetermined
number of dots, and the theoretical amount by which
ink is to be ejected from the set of ink ejecting
orifices corresponding to each processual data unit is
calculated based on the processual data unit. Then,
the amount by which ink is ejected by the set of ink
ejecting orifices is reduced based on the calculated
theoretical amount, in the manner to reduce the number
of dots to be formed along the border. This dot-
thinning process is carried out with reference to the
correction tables prepared in advance to show the

relationship among the amount by which the ink of a given color is to be ejected according to a given processual data unit, the total of the amounts by which inks of colors different from the given color are ejected according to the same processual data unit, and the correct amount by which the ink of the given color should be ejected by the set of ink ejecting orifices corresponding to the given processual data unit.

(54)【発明の名称】　インクジェット記録方法および装置

(57)【要約】

【課題】二値化された画像データに基づくインクジェット記録装置側での処理により、バンドの境界部のつなぎスジの発生を緩和することのできるシングルパス方式のインクジェット記録装置を提供する。

【解決手段】記録ヘッドの１回の走査により記録される１バンドの少なくとも第１ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、２値化画像データに基づいて、前記単位領域毎に、インク吐出量を認識する。この認識されたインク吐出量に基づいて、当該単位領域内のインク吐出量を低減するよう、吐出すべきインクドットの間引き処理を行う。この間引き処理は、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色のインク吐出量を予め定めた補正テーブルを参照することにより行う。
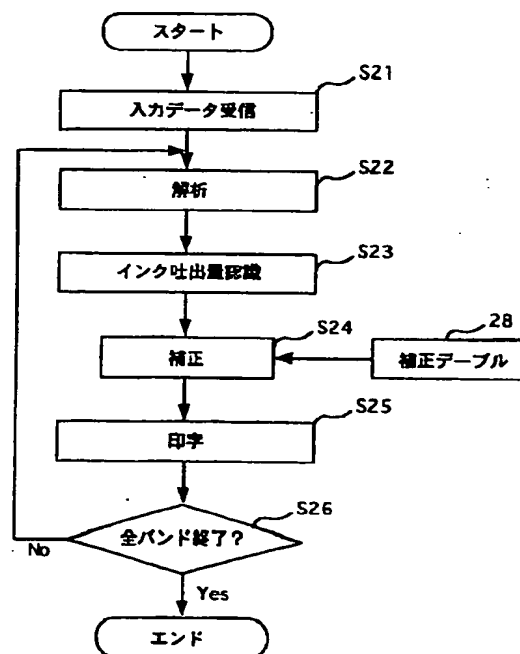
【特許請求の範囲】

【請求項1】インクを吐出する複数の吐出口を配列した記録ヘッドを、前記吐出口の配列方向と異なる方向に繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録方法において、

前記記録ヘッドの1回の走査により記録される1バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、

2値化画像データに基づいて、前記単位領域毎に、インク吐出量を認識し、この認識されたインク吐出量に基づいて、当該単位領域内のインク吐出量を低減するよう、吐出すべきインクドットの間引き処理を行うことにより、バンドとバンドの境界におけるつなぎスジの発生を緩和することを特徴とするインクジェット記録方法。

【請求項2】インクを吐出する複数の吐出口を配列した記録ヘッドを複数の色毎に用い、前記吐出口の配列方向と異なる方向に前記記録ヘッドを繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録方法において、

前記記録ヘッドの1回の走査により記録される1バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、

2値化画像データに基づいて、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色のインク吐出量を低減するよう補正し、

この補正を前記単位領域内の他の色について順次繰り返し実行し、さらに、補正対象のラスタ内のすべての単位領域について上記補正を順次繰り返し実行し、

このように各単位領域について、補正されたインク吐出量で各注目した色のインク吐出を行うよう前記単位領域内の注目した色の吐出すべきインクドットの間引き処理を行うことを特徴とするインクジェット記録方法。

【請求項3】前記インクドットの間引き処理は、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色のインク吐出量を予め定めた補正テーブルを参照することにより行う請求項2記載のインクジェット記録方法。

【請求項4】インクを吐出する複数の吐出口を配列した記録ヘッドを前記吐出口の配列方向と異なる方向に繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録装置において、

2値化画像データに基づいて、各バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、各単位領域内のインク吐出量を求める手段と、

この求められたインク吐出量に基づいて、当該単位領域内のインク吐出量を低減するよう、吐出すべきインクドットの間引き処理を行う間引き手段とを備え、

間引き処理により、バンドとバンドの境界におけるつなぎスジの発生を緩和することを特徴とするインクジェット記録装置。

【請求項5】前記間引き手段は、インク吐出量とこれに対応する補正されたインク吐出量とを予め定めた補正テーブルを用いて、前記間引き処理を行うことを特徴とする請求項4記載のインクジェット記録装置。

【請求項6】前記補正テーブルは、補正の対象とするインクの色毎に別個に設ける請求項5記載のインクジェット記録装置。

【請求項7】前記補正テーブルは、2値化画像データに基づいて、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色の補正後のインク吐出量を定めたことを特徴とする請求項5または6記載のインクジェット記録装置。

【請求項8】前記補正テーブルは、少なくとも被記録媒体の種類を含む記録条件に応じて複数設けられ、当該条件に応じて使い分けられる請求項5、6または7記載のインクジェット記録装置。

【請求項9】前記単位領域内のインクドットの間引きにおいて、間引きの対象となるドットの優先順位が各単位領域のドット位置に応じて予め定められていることを特徴とする請求項4〜8のいずれかに記載のインクジェット記録装置。

【請求項10】バンドの第1ラスタおよび最終ラスタをドット間引きの対象とする場合、第1ラスタと最終ラスタとで前記間引きの対象となるドットの優先順位を異ならせることを特徴とする請求項9記載のインクジェット記録装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、シングルパス方式で記録を行うインクジェット記録装置に関するものである。

【0002】

【従来の技術】インクジェット記録装置では、通常、インクを吐出する複数の吐出口（ノズル）を配列した記録ヘッドを吐出口の配列方向と異なる方向に繰り返し走査して画像記録を行うことから、一度の走査で帯状の画像領域（バンド）が形成される。この際、被記録媒体の材質や表面状態に応じてインクがにじむ場合がある。その場合、バンドとバンドの境界にいわゆる「つなぎスジ」と呼ばれる画像ムラが生じることがある。

【0003】これを防ぐためには、同じバンドを複数回に分けて記録するマルチパスによる方式を採用すればよいが、マルチパス方式では記録速度が低下してしまうという問題がある。

【0004】

【発明が解決しようとする課題】シングルパス方式のインクジェット記録装置においてつなぎスジを防止する技術として、例えば特開平7－89099号に開示のものがある。これは、バンドとバンドの境界部で記録される信号（多値信号）の信号値を小さくすることでにじみを押さえ、つなぎスジを防止するものである。

【0005】しかしながら、上記従来例では画像信号レベルで補正を行っているため以下のような欠点があった。

【0006】すなわち、第一に、一般に普及しているインクジェット記録装置の多くはコンピュータ端末装置と接続されており、コンピュータ端末装置で2値化等の画像処理を行いインクジェット記録装置に転送して記録している。しかし、インクジェット記録装置に多値信号を取り扱う画像入力部や画像処理部を持たせるとコストや処理時間が増加するため普及機では一般的でない。よって、インクジェット記録装置が画像信号レベルでの補正を行うと多階調画像を2値化画像に変換する処理に時間を浪費するため記録速度が遅くなってしまう。本発明のインクジェット記録装置は、多値の信号レベルを補正するのではなく、2値の画像データを補正処理の対象とするものである。

【0007】第二に、個々のインクジェット記録装置や被記録媒体によって紙送り量の誤差の個体差やインクにじみ量が変化するためこれらの補正をするには上記従来例では難しい。また、コンピュータ端末装置等で補正処理を行おうとすると、インクジェット記録装置の正確なバンド間の境界部分が分からない場合、処理が困難となる。

【0008】そこで、本発明は上記の課題を解決するためになされたもので、二値化された画像データに基づくインクジェット記録装置側での処理により、バンドの境界部のつなぎスジの発生を緩和することのできるシングルパス方式のインクジェット記録装置を提供することを目的とする。

【0009】本発明による他の目的は、インクジェット記録装置の個体差や被記録媒体固有のにじみ量の違いに対応して境界部におけるつなぎスジの発生を緩和することのできるシングルパス方式のインクジェット記録装置を提供することにある。

【0010】

【課題を解決するための手段】上記目的を達成するため本発明は、インクを吐出する複数の吐出口を配列した記録ヘッドを、前記吐出口の配列方向と異なる方向に繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録方法において、前記記録ヘッドの1回の走査により記録される1バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、2値化画像データ

に基づいて、前記単位領域毎に、インク吐出量を認識し、この認識されたインク吐出量に基づいて、当該単位領域内のインク吐出量を低減するよう、吐出すべきインクドットの間引き処理を行うことにより、バンドとバンドの境界におけるつなぎスジの発生を緩和することを特徴とする。

【0011】この構成によれば、2値化画像データを用いてバンドの境界部のインク吐出量を補正することができるので、外部のコンピュータ端末装置等における処理は何ら変更する必要なく、インクジェット記録装置側で補正処理を行い、走査（バンド）間の境界部のつなぎスジの発生を緩和を行うことができる。

【0012】また、一度の補正処理の対象領域を比較的小さい単位領域に限定することにより、印字品質を低下させることなく、処理負荷を軽減することができる。

【0013】本発明は、他の見地によれば、インクを吐出する複数の吐出口を配列した記録ヘッドを複数の色毎に用い、前記吐出口の配列方向と異なる方向に前記記録ヘッドを繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録方法において、前記記録ヘッドの1回の走査により記録される1バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、2値化画像データに基づいて、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色のインク吐出量を低減するよう補正し、この補正を前記単位領域内の他の色について順次繰り返し実行し、さらに、補正対象のラスタ内のすべての単位領域について上記補正を順次繰り返し実行し、このように各単位領域について、補正されたインク吐出量で各注目した色のインク吐出を行うよう前記単位領域内の注目した色の吐出すべきインクドットの間引き処理を行うことを特徴とする。

【0014】前記インクドットの間引き処理は、好ましくは、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色のインク吐出量を予め定めた補正テーブルを参照することにより行う。補正テーブルを用いることにより、迅速な補正処理を行うことができる。補正テーブルは、補正の対象となる領域、色、被記録媒体の種類等に応じて別個に設けることにより、より適切なつなぎスジ緩和のための補正処理が行える。

【0015】本発明によるインクジェット記録装置は、インクを吐出する複数の吐出口を配列した記録ヘッドを前記吐出口の配列方向と異なる方向に繰り返し走査して順次バンド単位に画像記録を行うインクジェット記録装置において、2値化画像データに基づいて、各バンドの少なくとも第1ラスタおよび最終ラスタの一方を、おのおの予め定めた個数のドットからなる複数の単位領域に分割し、各単位領域内のインク吐出量を求める手段と、

この求められたインク吐出量に基づいて、当該単位領域内のインク吐出量を低減するよう、吐出すべきインクドットの間引き処理を行う間引き手段とを備え、間引き処理により、バンドとバンドの境界におけるつなぎスジの発生を緩和することを特徴とする。

【0016】前記間引き手段は、インク吐出量とこれに対応する補正されたインク吐出量とを予め定めた補正テーブルを用いて、前記間引き処理を行うことが好ましい。

【0017】前記補正テーブルは、補正の対象とするインクの色毎に別個に設けてもよい。補正テーブルを用いることにより、迅速な補正処理を行うことができる。

【0018】前記補正テーブルは、例えば、2値化画像データに基づいて、各単位領域内の注目した色のインク吐出量と、当該単位領域内の他の色のインク吐出量の合計とに応じて、前記注目した色の補正後のインク吐出量を定めたものである。

【0019】前記補正テーブルは、少なくとも被記録媒体の種類を含む記録条件に応じて複数設けられ、当該条件に応じて使い分けられるようにしてもよい。

【0020】前記単位領域内のインクドットの間引きにおいて、間引きの対象となるドットの優先順位が各単位領域のドット位置に応じて予め定めることが好ましい。この際、単位領域内の一部のドットが間引かれる場合に、それらの間引かれるドットが空間的に分散するように優先順位を定めることが好ましい。

【0021】バンドの第1ラスタおよび最終ラスタをドット間引きの対象とする場合、第1ラスタと最終ラスタとで前記間引きの対象となるドットの優先順位を異ならせることが好ましい。

【0022】
【発明の実施の形態】以下、本発明の実施の形態について、図面を参照して詳細に説明する。

【0023】図1は本発明のインクジェット記録装置の構成を示すブロック図である。図1中、11は装置全体の動作を制御するCPU、12はCPU11の作業領域およびデータの一時記憶領域として利用されるRAMである。13はインクジェット記録装置を駆動するためのプログラムやデータが書き込まれているROMであり、CPU11により使用される。14は外部のコンピュータ端末装置等（図示せず）と接続するためのインタフェース部であり、これを介して2値データが転送されてくる。15はマンマシンインタフェースのための表示を行うLCD表示装置、16はインクジェット記録装置の各種設定を選択するためのキー操作部である。17はインクジェットヘッドによる印字部、18はCPU11と他の各要素とを接続するシステムバスである。

【0024】印字部17のインクジェットヘッドには、ブラック（K）、シアン（C）、マゼンタ（M）、イエロー（Y）の4色があり、本実施の形態ではそれぞれ1

28ノズルを持ち、2値化された画像データに対応してインク滴を吐出する。

【0025】図2は入力データ受信から印字までの処理フローである。

【0026】まず、外部から入力データを受信し（S21）、この受信したデータを解析してインクジェットのヘッドによる記録に適した1バンド分の印字データを用意する（S22）。次に、各色毎に第1および最終ラスタの各単位領域のインク吐出量（吐出ドット数）を認識し（S23）、これに基づいて補正テーブル28を参照して、印字データの補正を行う（S24）。このようにして得られた当該バンドの補正後の画像データに基づいて各ヘッドを駆動して印字処理を行う（S25）。このような処理をすべてのバンドが終了するまで（S26）、繰り返して実行する。

【0027】図3は、本実施の形態におけるインク吐出量の補正処理を説明するための図である。この例では、第1走査（第1バンド）の最終ラスタと第2走査（第2バンド）以降の第1ラスタおよび最終ラスタにおいてインク吐出量の補正を行う。最後のバンドでは、第1のラスタのみの補正を行う。

【0028】例えば、1バンドの記録に関与する1色あたりのヘッドのノズル数を128とすると、第1と第128のノズルにより吐出されるインク滴が補正の対象となる。1バンドの記録に関与するノズルは、ヘッドに備えられたすべてのノズルである必要はない。すなわち、インク滴吐出の補正の対象となるノズルはヘッドに備えられた1列のノズル群の最初と最後のノズルとは限らない。

【0029】また、本実施の形態では、補正の対象となるラスタをバンドの最初と最後の各1ラスタとしているが、少なくともその一方を2ラスタ以上とすることも可能である。特に、にじみの大きい場合に2ラスタ単位の補正が効果を発揮する。すなわち、バンドの一辺の補正対象ラスタを1ラスタとするか2ラスタとするかは、インクジェット記録装置の個体差や被記録媒体のインクのにじみ量（すなわち紙質）で決定することができる。

【0030】次に、本実施の形態における、境界部でのインク吐出量の補正処理について説明する。

【0031】まず、バンドの境界部を一定の形状および面積になるように分割する。仕事量と効果の関係から、本実施の形態における境界部はバンドの最初と最後の各1本のラスタとし、この各ラスタを横5ドット×縦1ドットの単位領域に分割した。しかし、本発明はこれに限定されるものではない。前述のように、被記録媒体に応じて単位領域のラスタ数は1ラスタではなく複数ラスタにしてもよく、また、1ラスタあたりのドット数も5ドットに限定するものではない。

【0032】図4は、Y．M．C．Kの各色の5ドット×1ドットの単位領域から構成される1ラスタのデータ

を模式的に示したものである。右端の５ドットに満たな
い部分は、画一的な処理が行えないことと、補正処理を
行わなくても影響が少ないことから、本実施の形態で
は、補正処理の対象から外している。

【００３３】補正処理は、単位領域毎に、各色について
行う。例えば、ある単位領域のＹのインク吐出量を補正
の対象とするとき、その単位領域のイエローＹの吐出ド
ット数ｘ（０≦ｘ≦５）を求めるとともに、他の色Ｍ，
Ｃ，Ｋの同じ単位領域内の吐出ドット数の合計値ｙ（０
≦ｘ≦１５）を求める。この注目するインク色のインク
吐出量ｘと、他のインク色のインク吐出量ｙの組み合わ
せに対応して、つなぎスジが最も緩和される適正なＹの
吐出ドット数ｚ（０≦ｘ≦５）を予め実験的に求めて、
これらの関係をその色に対応する補正テーブルに記憶し
ておく。したがって、補正テーブルはＹ，Ｍ，Ｃ，Ｋの
４つ設けられる。これにより、色毎に適正な補正値を設
定することができる。但し、本発明は、すべての色に共
通の補正テーブルを用いる場合、あるいは、Ｙ，Ｍ，Ｃ
に共通の補正テーブルを用い、Ｋに専用の補正テーブル
を用いる場合等を排除するものではない。

【００３４】ある色の単位領域のインク吐出量の補正処
理時には、２値化画像データにより与えられたｘとｙの
値に応じて、その色の補正テーブルを参照することによ
り、対応する補正値ｚが得られる。その補正値の吐出量
になるように、当該単位領域内のその色のインク吐出量
を減少させる。例えば、イエローＹのドット数ｘが５、
他の色のドット数の合計値ｙが３の場合には補正後のイ
エローＹのドット数を１にする。着目する色を順次変え
て、他の色についても同様の補正処理が行われる。ある
色のドット数を低減する場合、単位領域内のどのドット
を間引くかについては、後述する。

【００３５】図７に、単位領域のドット数を５とした場
合の補正テーブル２８の具体例を示す。前述のように、
注目する補正対象の色（Ｙ，Ｍ，Ｃ，Ｋ）毎に、与え
られた単位領域内のその色のインク吐出量ｘと、他の色の
インク吐出量の合計ｙのあらゆる組合せに対して、補正
後の当該色のインク吐出量ｚを予め定めている。ｘ，
ｙ，ｚの好ましい関係は、実験的に求めることができ
る。

【００３６】さらに、この補正テーブルは、バンドの第
１ラスタ用と最終のラスタ用に別個のテーブルを用意す
るようにしてもよい。これにより、両ラスタの補正値を
異ならせることができるので、さらにきめ細かな補正処
理が可能となる。

【００３７】図５は、単位領域内でのインク吐出量減少
（ドット間引き）の優先順位を示す図である。１つの単
位領域内では、優先順位の隣り合う数値が空間的に連続
しないように分散して並べている。また、あるバンドの
最終ラスタ（境界部の上方のラスタ）と、次のバンドの
第１ラスタ（同じ境界部の下方のラスタ）とで優先順位

を異ならせている。この例では、吐出ドット間引きの優
先順位は、最終ラスタについては、単位領域内の左端か
ら順に、１、３、５、２、４とし、第１ラスタについて
は、５、３、１、４、２としている（数字の若い方が先
に間引かれる）。このように優先順位の数値を不連続に
分散させるのは、間引きの結果の画質の劣化を防止する
ためである。なお、これらの優先順位の各数値の位置は
あくまで一例であり、本発明はこれに限定されるもので
はない。

【００３８】ここで、具体例を考える。例えば、入力画
像データの与えられた１バンドの最終ラスタの単位領域
内の注目するインク色のインク吐出量が４で、他のイン
ク吐出量との組み合わせから補正テーブル２８内の当該
補正量が１であったとする。この場合、インク吐出量は
４から１へ、３ドット分減少するので、３ドットを間引
く必要がある。そこで、まずその単位領域内の入力画像
データの左端のドットを調べ印字することになっていた
らこのドットを印字しないようにする。もし印字しない
ことになっていたら、次に右から２番目のドットを調
べ、印字することになっていたらこのドットを印字しな
いようにする。このようにして、３ドットを間引く（す
なわちインク吐出量を１とする）まで、優先順位に従っ
て間引きの対象となる吐出ドットを探索していく。バン
ドの第１ラスタについては、前述のように別の優先順位
でドットの間引きが行われる。

【００３９】図６に、本発明による他の実施の形態にお
ける単位領域の構成を示す。図６（ａ）は、単位領域
を、境界の上側では、バンドの最終の第ｎラスタと第ｎ
－１ラスタの２ラスタ分の横５ドット×縦２ドットの領
域とし、境界の下側では図５と同様の１ラスタ分の横５
ドット×縦１ドットの領域としたものである。逆に、境
界の上側を１ラスタ分、下側を２ラスタ分としてもよ
い。

【００４０】図６（ｂ）は、境界の上側および下側を共
に、２ラスタ分の横５ドット×縦２ドットの領域とした
ものである。

【００４１】図６の単位領域の構成は、インクのにじみ
が大きい被記録媒体に利用して効果を発揮する。それぞ
れの単位領域内の吐出ドットの間引きの優先順位の一例
を図内に数値で示してある。この場合も、優先順位の隣
り合う数値は空間的に連続しないように定められてい
る。

【００４２】以上、本発明の好適な実施の形態について
説明したが、種々の変更を行うことが可能である。

【００４３】例えば、本発明の変形例として、境界の上
側または下側の一方でのみインク吐出量の補正を行うよ
うにすることも可能である。

【００４４】また、上述した補正テーブルは、被記録媒
体のインクのにじみ量によってそれにあったものを別個
に用意しておき、ユーザによる用紙種別の選択に応じて

対応する補正テーブルを選択するとよい。一般に、普通紙、コート紙、光沢紙、フィルム等の種々の種類の被記録媒体があり、これらの個々のもの、またはグループに応じて、対応する補正テーブルを切り替えて使用することができる。

【0045】さらに、印字時のインクの残量、気温、湿度、被記録媒体の個体差などで実験的に求めた補正テーブルの補正量が適合しないような場合は、補正テーブルの各数値に0.5から1.5程度の係数を乗じて（端数は四捨五入等を行う）得られた補正テーブルをいくつか用意しておき（あるいは、計算を行い）、それらを実際の印字前に選択できるようにすればさらに効果的といえる。

【0046】以上の説明では、補正テーブルの出力として補正後のインク吐出量を定めたが、これに代えて、間引きドット数を規定するようにしてもよい。

【0047】

【発明の効果】本発明によれば、2値化画像データを用いてバンドの境界部のインク吐出量を補正することができるので、外部のコンピュータ端末装置等における処理は何ら変更する必要なく、インクジェット記録装置側で補正処理を行い、走査（バンド）間の境界部のつなぎスジの発生を緩和を行うことができる。また、一度の補正処理の対象領域を比較的小さい領域に限定することにより、印字品質を低下させることなく、処理負荷を軽減することができる。さらに、補正テーブルを用いることにより、迅速な補正処理を行うことができる。補正テーブルは、補正の対象となる領域、色、被記録媒体の種類等

に応じて別個に設けることにより、より適切なつなぎスジ緩和のための補正処理が行える。

【0048】

【図面の簡単な説明】

【図1】本発明によるインクジェット記録装置の構成例を示すブロック図である。

【図2】図1のインクジェット記録装置の入力データ受信から印字までの処理フローを示すフローチャートである。

【図3】本発明の実施の形態におけるインク吐出量の補正処理を説明するための図である。

【図4】本発明の実施の形態におけるY，M，C，Kの各色の5ドット×1ドットの単位領域から構成される1ラスタのデータを模式的に示した図である。

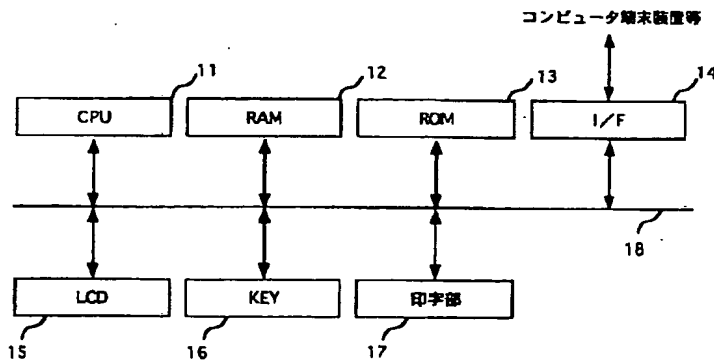【図5】本発明の実施の形態における単位領域内でのインク吐出量減少（ドット間引き）の優先順位を示した図である。

【図6】本発明による他の実施の形態における単位領域の構成を示す図である。

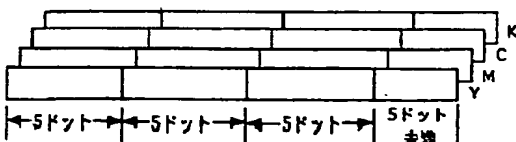【図7】本発明の実施の形態における、単位領域のドット数を5とした場合の補正テーブルの具体例を示す図である。

【符号の説明】

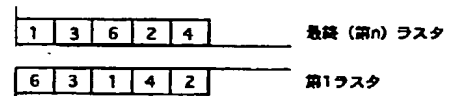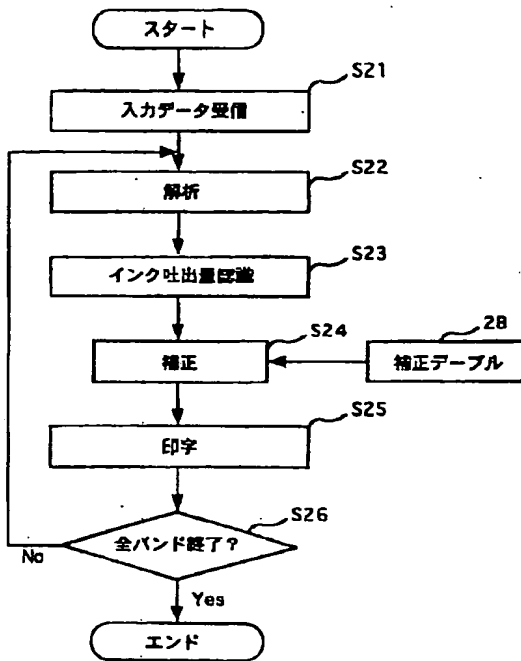11…CPU、12…RAM、13…ROM、14…インタフェース部（I／F）、15…液晶表示装置（LCD）、16…キー操作部（KEY）、17…印字部、18…システムバス、28…補正テーブル。

【図1】

【図5】

【図4】

【図2】

スタート

入力データ受信 —— S21

解析 —— S22

インク吐出量認識 —— S23

補正 ←—— 補正テーブル　　28 —— S24

印字 —— S25

全バンド終了？ —— S26

No

Yes

エンド

【図6】

(a)

| 9 | 5 | 1 | 7 | 3 | 第n-1ラスタ |
| 2 | 6 | 10 | 4 | 8 | 最終（第n）ラスタ |

| 5 | 3 | 1 | 4 | 2 | 第1ラスタ |

(b)

| 9 | 5 | 1 | 7 | 3 | 第n-1ラスタ |
| 2 | 6 | 10 | 4 | 8 | 最終（第n）ラスタ |

| 9 | 5 | 1 | 7 | 3 | 第1ラスタ |
| 2 | 6 | 10 | 4 | 8 | 第2ラスタ |

【図3】

第1走査　　　　　　　　　　　　　　　最終ラスタ　　　バンド

境界部

第2走査　　　　　　　　　第1ラスタ　　　バンド
　　　　　　　　　　　　　最終ラスタ

境界部

第3走査　　　　　　　　　第1ラスタ　　　バンド
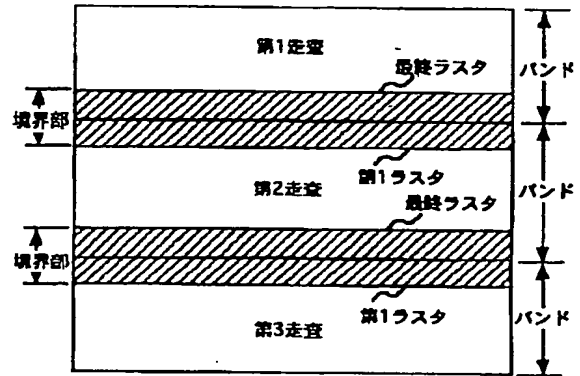
【図7】

補正テーブル28

注目インク 吐出量(x)	他色インク 吐出量合計(y)	補正後インク 吐出量(z)
5	0	2
5	1	2
5	2	2
5	3	1
5	4	0
5	5	0
5	6	0
5	7	0
5	8	0
5	9	0
5	10	0
5	11	0
5	12	0
5	13	0
5	14	0
5	15	0
4	0	2
4	1	2
4	2	1
4	3	0
4	4	0
3	0	3
3	...	
2	0	2
2	...	
1	0	1
	...	

Y
M
C
K